

EXECUTIVE SUMMARY

This Environmental Assessment (EA) has been prepared by the U.S. Department of the Navy (DON) to evaluate potential environmental impacts of at-sea demonstration testing of a Plasma Sound Source (PSS), an active acoustic undersea surveillance subsystem during the period from mid-August through 30 September 1999. Specifically, this EA evaluates an ocean test that is proposed for a location within U.S. territorial seas and outside of California coastal zone waters off the coast of Southern California, and is associated with an existing developmental passive receiver array that would obtain enhanced performance through operations with a PSS.

The PSS array consists of a 10 meter long string of 80 sparkplug-like and size devices, which produce split second broadband impulsive sounds. The Navy proposes to use the PSS along with a passive receive array to help detect underwater and surface marine vessel activity. The PSS active acoustic test source would be used to produce pulsed sound during the proposed test to evaluate the potential for active pulsed sound to enhance the performance of passive sonar systems. To the greatest extent possible, PSS components have been and will continue to be tested in the laboratory. However, to obtain realistic testing conditions and to deploy full-scale hardware, certain tests must be performed in the ocean environment. A single demonstration test over a 22-day period between mid-August and 30 September 1999 is proposed to evaluate the capability and performance of a PSS array.

A summary of the parameters of this PSS test is provided in Table ES-1.

Table ES-1. Summary of PSS Ocean Tests

Key Test Parameters	Demonstration Test
TEST CHARACTERISTICS	
Maximum Test Period (Active)	8 days
Number of Test Vessels	2
Wet-end Inspection and Repair*	Yes
Component Retrieval	Yes
ACOUSTIC PARAMETERS	
Maximum Active Acoustic Testing (daylight only)	56 hours
Plasma Sound Source (PSS)	
Energy Source Level ***	219 dB re 1 $\mu\text{Pa}^2\text{-sec}^{**}$
Frequency Range	300 - 650 Hz
Pulse Duration	2.5 milliseconds
Range of time between pulses	15 seconds to days

* Wet-end inspection and repair would occur only as required.

** Total energy per impulse on the major response axis. Corresponds to a source level of 190 dB re 1 $\mu\text{Pa}^2/\text{Hz}$ spectrum level below 1 kHz. Measurement units and conventions in this document follow those used in Richardson et al., 1995.

*** Energy Source Level refers to the measurement of the energy in an acoustic transmission at a distance of 1m from the source.

Activities associated with the proposed ocean test would primarily include the following: anchoring of the test barge, deployment of the active array to approximately 80 meters (262-ft) in water of about 91-m (300-ft) depth, inspection and operation of the system, and retrieval of the system. In addition, a 36.6-m (120-ft) passive acoustic array (3.8-cm [1.5-inch] diameter) would be deployed and laid on the ocean floor. It would be connected via a fiber optic cable (0.38-cm (0.15-inch) diameter, no more than 3 kilometers in length) to the van enclosure located on the barge.

Deployment of the PSS System. A full-scale test of the PSS system in the ocean would include testing the handling and deployment systems, as well as deploying approximately one hundred meters of cable from a moored barge to a mid-water column location. This active array is the focus of this EA, and represents a proof-of-concept demonstration of the technology. To use the barge for receiving and processing the data associated with the PSS ocean test, use would be made of a bottom-laid passive array 3.8-cm (1.5 inches) in diameter, which would be connected to the barge via a 0.38 cm diameter fiber optic cable. The intended location of the moored array is 6.5 to 8.3 km (3.5 to 4.5 nm) off of the coast of Camp Pendleton in approximately 91 m (300 ft) of water.

Passive Array Placement. The fiber optic cable (0.38 cm diameter) from the bottom-laid Mobile Inshore Undersea Warfare (MIUW) passive LBA array would be connected to the van enclosure on the barge. Cable would then be deployed from a reel on a 27-ft workboat and the passive acoustic array would be attached to the fiber optic cable and deployed from this vessel at the desired location. The passive receive array and cabling system is already in use by the Navy in support of research and development testing.

Operation and Inspection of the System. The PSS array is an active acoustic subsystem, that would produce impulsive sound during the ocean demonstration test. A single active acoustic method is proposed. A moored PSS array using a brief (microseconds in duration) electrical arc similar to that generated at the end of a sparkplug, generates sound through the creation of a bubble of ionized water that then collapses and returns to a liquid state over a period of milliseconds. This PSS system will produce sounds similar to (but quieter than) air gun arrays used in seismic surveys, which are already approved for commercial operations via an existing categorical exclusion. Inspection and repair of the PSS system would be performed only as required.

Retrieval of the System. Retrieval of all components of the PSS array and the passive receive array would occur within two weeks after completion of the demonstration test. The retrieval time is included in the 22-day test period.

Support Vessels and Personnel. As part of the PSS ocean test, two surface vessels and a test barge would be used to support deployment, inspection and operation (active acoustic testing), and retrieval of the system. One of the surface vessels would be used to establish and to demobilize the barge mooring. The other would be used for daily support and personnel transfer.

Personnel required for the ocean test (approximately 10 shipboard personnel [8 scientists and 2 crew members]) consists of those required to prepare test plans and procedures, assemble and inspect equipment prior to the start of at-sea testing, deploy in-water components, conduct various tests, collect data, retrieve equipment, analyze test results, and prepare reports. In many cases, the same person would perform several of these tasks. Not all would be on the barge at all times.

Selection of Test Site and Test Period. The DON proposes to conduct these tests within the marine environment of Southern California, between the northern and southern boundaries of Marine Corps Base (MCB) Camp Pendleton, outside of 3 nautical miles from land and more than 35 nautical miles south-southeast of Santa Catalina Island. The specific mooring location of the system is shown in chapter 2.

The tests would occur within a 22-day period including retrieval time. Once the system has been deployed, the maximum days of operation for the test would be approximately eight contiguous days; however, testing would not occur continually. A maximum of 56 hours of active acoustic testing,

occurring only during daylight hours, using impulsive transmissions is proposed during the 22-day period. The maximum test period would consist of eight contiguous days for the test including data collection within the 22-day period.

The alternative to the proposed PSS ocean test is the No-Action Alternative. Systematic operational parameters were analyzed to determine reasonable site locations for conducting the PSS ocean test. The siting process involved the development of specific operational siting criteria based on test objectives, which included the following:

- operational realism (adequate deployment area/depth/performance measurability);
- survivability (weather conditions/level of fishing/terrain);
- scheduling (low potential for schedule change);
- availability (test site is available for conduct of tests);
- accessibility (physically and economically feasible to reach test site);
- supportability (necessary amenities); and
- availability of opportunistic targets (critical due to the limited funding available to this Research & Development (R&D) effort).

Once operational criteria were identified, various regions were considered in a tiered analysis to identify potential siting locations for conducting PSS ocean tests. Operational criteria were first used to eliminate general areas from further consideration and, to compare advantages and disadvantages of potential alternative sites. Sites considered included the following:

- sites within U.S. territorial seas; and
- foreign sites.

Foreign sites for PSS ocean testing were eliminated from further consideration due to the following reasons:

- high potential for schedule changes, or equipment damage due to weather, political atmosphere, or unknown variables;
- sites outside the U.S. are usually restrictive to R&D programs; and
- support functions (e.g., electricity, lodging, etc.) are highly variable and expensive at remote locations.

Therefore, U.S. territorial seas were identified as the only viable siting option.

In the next tier of analysis, based on the alternatives analysis, the East Coast, Hawaii, and the Gulf Region were eliminated from further consideration because they did not meet all operational siting criteria. Based on this tiered analysis, the West Coast was identified as the only area that met all operational siting criteria for implementation of the PSS ocean test.

Once the West Coast was identified as the only region that met all operational siting criteria, specific West Coast ocean test site locations were evaluated. More detailed operational criteria were used to further determine the characteristics of the proposed ocean test. The location that satisfied all required operational criteria is analyzed in this EA. This location consists of the proposed PSS ocean test site, located offshore of Southern California. Testing at another location or during another period was

deemed not feasible due to: 1) asset availability, 2) availability of pertinent personnel, and 3) programmatic costs in relocating assets to other potential operational sites/times.

The only alternative to performing the proposed ocean test would be to simulate the ocean environment through laboratory testing. This alternative does not meet the purpose and need of the PSS ocean test since real world conditions and representative targets are necessary to verify and validate PSS capabilities; therefore, this alternative was not analyzed in the EA.

Under the No-Action Alternative, the proposed action would not be implemented and the purpose and need for the PSS subsystem functional demonstration would not be met. PSS is proposed to be tested to demonstrate and validate the performance improvements allowed by bi-static active processing that would augment existing and planned passive Mobile Inshore Undersea Warfare (MIUW) receiving assets. If these tests are not conducted, the Navy's objective of developing a validated, demonstrated bi-static active upgrade to passive MIUW sonar systems would be substantially delayed until another opportunity for demonstration would occur.

This EA describes current baseline conditions and evaluates potential impacts from the implementation of PSS ocean testing at the proposed PSS ocean test location site, as well as identifies potential impacts resulting from selection of the No-Action Alternative. The EA includes descriptions of baseline conditions and environmental consequences outside California waters. The following environmental resources are addressed in the EA: geology, topography and soils; air quality; marine environment; marine biology; marine mammals; terrestrial biology; land use, transportation and recreation; socioeconomics; noise; cultural resources; and safety and environmental health. The key issue identified during preparation of this EA was the potential for acoustic impacts on marine mammals and divers. The analysis of potential acoustic impacts demonstrated that significant impacts on marine mammals and divers would not occur as a result of implementation of the proposed PSS ocean testing.

Monitoring and Mitigation Measures. In the resource-specific analysis as described in Chapter 4 of this EA, no significant impacts have been identified. The proposed PSS test is not intrusive and has been designed to further minimize environmental impacts. Mitigation measures for marine mammals were established based on predicted received sound levels relative to distance from the sound sources as shown in Table ES-2 and are additional efforts designed to lessen any potential impact.

In order to determine the ranges at which marine mammals may potentially be affected by man-made sources of sound, three factors must be considered: 1) the acoustical characteristics of the source, 2) the propagation of sound through the ocean environment, and 3) the effects of received sound on marine mammals.

The first two factors are comparatively well understood. The acoustical characteristics of the PSS sound source were determined by laboratory measurement. The propagation of sound in the ocean environment was predicted by means of a simple calculation and also by use of a Navy computer program that mathematically models the acoustical characteristics of the ocean and sea floor.

The third factor, the effects of received sound on the animal, is the least understood and has been the subject of considerable controversy. The subject of marine mammal reactions to noise is a rapidly evolving field of science. Every effort has been made to use the best available peer reviewed data in conducting the analyses used to prepare this EA.

The available information on harassment of marine mammals by man-made noise is limited as to species, geographical area and type of noise source studied and has for the most part been derived from

opportunistic studies. Those studies that are most directly applicable to this EA and this type of test indicate that for multiple short duration impulsive sounds (> 15 seconds to days between pulses for this testing), the harassment threshold for mysticetes would fall in the range of 180 (single impulsive event) to 175 (multiple impulsive event) dB re 1 $\mu\text{Pa}^2\text{-sec}$ (energy), with similar or higher thresholds for odontocetes and pinnipeds. Since this test event deals with multiple short duration impulse events occurring at a repetition rate of 15 seconds to days, the 175 dB threshold was deemed most directly applicable. Note: This is not the same decibel measurement scale that is used for measuring long duration tonal sounds, the “dB re 1 μPa ” (energy). Acoustical measurement units and conventions in this document follow those used in Richardson et al. (1995).

Calculations for the acoustic propagation from the PSS source indicate that, at worst, the received energy levels will fall below 175 dB re 1 $\mu\text{Pa}^2\text{-sec}$ (energy) at 0.16 kilometers (km) from the PSS active acoustic source. A distance of 0.2 km was therefore selected as the desired mitigation range in order to provide a buffer zone beyond the range calculated to which received energy level would drop below 175 dB re 1 $\mu\text{Pa}^2\text{-sec}$ (energy) (0.16 km). Extending the zone to 0.2 km allows for a conservative margin of error in visual observation.

Table ES-2. Predicted Received Energy Source Levels Relative to Distance from Sound Source

Energy Source Level @ 1 m	Received Energy Level
219 dB re 1 $\mu\text{Pa}^2\text{-sec}$	180 dB re 1 $\mu\text{Pa}^2\text{-sec}$ @ 0.09 km 175 dB re 1 $\mu\text{Pa}^2\text{-sec}$ @ 0.16 km

Additional mitigation measures have been recommended and incorporated into the PSS ocean test program to minimize any potential for acoustic impacts on marine mammals (Table ES-3).

Table ES-3. Mitigation Measures for Marine Mammals during PSS Ocean Test Acoustic Transmissions

Impulsive Acoustic Source	Watch Type*		Operations Curtailed When
	Visual	Dedicated	
219 dB re 1 $\mu\text{Pa}^2\text{-sec}$ **	X	X	Mysticetes, pinnipeds or odontocetes within 0.2 km

* A visual or dedicated watch will begin 30 minutes before the start of any acoustic transmission and will continue for the duration of the transmission.

** Acoustic transmission during daylight hours only, and only when visibility exceeds 0.2 km.

For the proposed PSS ocean test, two types of visual searches for marine mammals would be conducted: (1) *a visual watch* by personnel whose primary duties involve safety of navigation, and 2) *a dedicated watch* of two personnel specifically trained in marine mammal identification who will have no other duties. A dedicated watch of waters within 0.2 km of PSS support vessels would be conducted at least 30 minutes before and continue during any impulsive sound source transmission.

Sound transmissions will occur only in daylight and only when weather conditions allow the visual watch to observe a minimum of 0.2 km in all directions around the moored barge from which the active acoustic source is deployed. If, for example, fog reduces visibility in the area below 0.2 km, acoustic transmissions will be halted until the visibility improves sufficiently to allow the visual watch to resume.

Effects on human divers will not occur due to the fact that diver operations will not be conducted in the vicinity of the test barge. The location of the tests will be kept free to a distance of 1 km of other activities for the efficiency and integrity of the testing. In addition, the planned location of the PSS test site is not near identified dive sites. Therefore, recreational divers will not be affected by the test.

Implementation of the above measures would be incorporated into the PSS test plan and logged during the active transmission period of the PSS test. This data would include the logging of marine mammals sighted during the active transmission period.

Summary of Impacts. In defining significant impacts, the National Environmental Policy Act (NEPA) requires the consideration of context and intensity. The significance of an action must be analyzed in several contexts such as society as a whole, the affected region, the affected interests, and the locality. Intensity refers to the magnitude of the potential effect (i.e., the degree of reach in terms of strength, force, or energy per unit [e.g., time]). The analysis carried forth in the EA addresses the impacts of the proposed PSS test within the spatial and temporal boundaries of test implementation. The proposed activity of the use of typical seagoing vessels, and the short-term use of artificial underwater sound sources (the projector) have all been found to have highly localized influences (i.e., small regions of potential impact) that preclude the need to look at larger areas of influence. Thus, the context of potential impact for the PSS activities is limited to localized site-specific regions surrounding the sea test area.

Changes in the environment would be limited to a total of 22 days for the proposed test. Upon completion of the test, the marine environment within the proposed footprint area would remain essentially unchanged from its condition prior to the proposed action.

Intensity of impacts are measured against specific evaluative factors including public health; unique characteristics (e.g., sensitive ecological features); degree of controversy; degree of unknown or uncertain risk; precedent-setting impact; cumulative impact; archaeological and historic resources; special status species, and the potential to violate federal, state, and local laws. Based upon the detailed analysis presented in this EA, the intensity of effects associated with implementation of the proposed action is not significant since the proposed PSS test consists of highly localized, discrete actions that do not add in a cumulative manner to other activities in the general region. The PSS ocean test would have no significant impact on federally protected threatened and endangered species. All emissions associated with the proposed project would be consistent with the relevant State Implementation Plans (SIPs). There are no known archaeological resources that would be affected with implementation of the proposed action; therefore, there would be no significant impacts on cultural resources. The review for consistency with applicable environmental requirements at the federal, state, and local level found no threat of violation associated with the proposed action.

This EA covers impulsive sound being produced that is similar in character, but lower in amplitude (energy) than those signatures produced by airguns on geophysical exploration arrays that have been used by the oil companies since the early 1950's. Because these sounds are very similar in their transient nature, and their infrequent transmission, individual pulses probably make a sound similar to distant thunder in the water. Current research findings suggest that geophysical exploration sounds do not cause any permanent hearing damage to mammals (Richardson, et al., 1995, p. 375) due to:

- a. the transitory nature of seismic exploration,
- b. the presumed ability of marine animals to tolerate exposure to strong calls from themselves and from other nearby mammals.

Due to the short-term localized nature of the PSS ocean test, the proposed action does not meet the criteria to be considered to contribute to cumulative impacts. No significant impacts would result from implementation of the proposed action or the No-Action Alternative. With the identified monitoring and mitigation efforts incorporated into the proposed PSS test, the impacts of the proposed action would be negligible. Summaries of the proposed PSS ocean test location and the No-Action Alternative's potential effects are provided in Table ES-4.

Table ES-4. Impact Summary Matrix (Page 1 of 3)

Resource	PSS Ocean Test/Southern California	No-Action Alternative
Geology, Topography, and Soils	<u>Proposed PSS Ocean Test Location</u> Not-applicable (N/A)	No effect/No change from base-line conditions.
Air Quality	<u>Proposed PSS Ocean Test Location</u> Air quality analysis concluded that emissions associated with the proposed ocean tests would be below <i>de minimis</i> levels for all nonattainment criteria pollutants. Impacts to air quality would not be significant as a result of implementation of the proposed action.	No effect/No change from base-line condition.
Marine Environment	<u>Proposed PSS Ocean Test Location</u> <u>Water Quality:</u> There would be no discharges to the surrounding marine environment. Use of the PSS would not result in contribution of pollutants to the seawater at the test site. Therefore, impacts on water quality would not be significant. <u>Marine Sediments:</u> Three anchors would be employed to stabilize the source platform. It is estimated that 200 m ² /anchor would be momentarily disturbed during deployment and retrieval (600 m ² total). Any sediment disturbance that would occur would be short-term and not significant.	No effect/No change from base-line conditions.
Marine Biology	<u>Proposed PSS Ocean Test Location</u> <u>Chemical Contamination:</u> (refer to <i>Marine Environment</i> , water quality, above) <u>Benthic Organisms:</u> PSS anchoring and passive receive array components have been designed to minimize drag, limiting sediment disturbance. Therefore, increases in turbidity would be minimal and not significant. Other PSS components would be suspended in the water column. <u>Fish:</u> Given the moderate sound source level and short duration of exposure to maximum received levels, projected sounds would not affect the catchability or the hearing abilities of fish.	No effect/No change from the baseline condition.
Marine Mammals	<u>Proposed PSS Ocean Test Location</u> <u>Acoustic Impacts:</u> Potential acoustic impacts of PSS ocean test operations on marine mammals vary with hearing capabilities of each major group. For example, mysticetes (baleen whales) may hear noise from both the project vessels and the PSS array. However, maximum source levels for the impulsive source (219 dB re 1 μ Pa ² -sec, energy) are such that the area ensonified to levels above 175 dB is comparatively small. It is unlikely that odontocetes (toothed whales) or pinnipeds would be affected by either vessel or the moored PSS array due to comparatively poor hearing at frequencies less than or equal to 1 kHz. It is unlikely that any noise associated with PSS ocean test operations would be heard by sea otters due to their low numbers and exclusive occupation of coastal waters within 3 nm of shore. Mitigation measures have been incorporated to further minimize any potential for acoustic impacts to marine mammals (refer to pages ES-4 through ES-6).	No effect/No change from the baseline condition.

Table ES-4. Impact Summary Matrix (Page 2 of 3)

Resource	PSS Ocean Test/Southern California	No-Action Alternative
Marine Mammals (continued)	<p><u>Attraction/Collision:</u> The risk of attraction and collision would be the same as for other vessels operating in the area and would not be significant. The barge would be properly lighted and provided with Coast Guard regulated devices. A Notice to Mariners (NOTMAR) would be posted prior to test operations.</p> <p><u>Entanglement:</u> Test components would be retrieved following testing. During operations, the potential for entanglement or ingestion would be remote based on the size and shape of cables and test components. The PSS array has been designed to hang straight; the PSS array would consist of several parallel lines extending more-or-less linearly and vertically over 10 m (33 ft) in a mid-water location. It is highly unlikely that any marine mammals would become entangled with this cable arrangement. No significant impacts on marine mammals would result.</p> <p><u>Chemical Contamination:</u> Since there would be negligible chemical discharges associated with the PSS tests, there would be no risk of metal bioaccumulation in marine mammals (refer to <i>Marine Environment</i>). No significant impacts on marine mammals would result.</p>	No effect/No change from the baseline condition.
Terrestrial Biology	<p><u>Proposed PSS Ocean Test Location</u> Boating activities are common in the area and are not known to adversely affect sight-feeding bird species. Therefore, impacts to terrestrial species, including federally or state listed sensitive species, would not occur.</p>	No effect/No change from base-line conditions.
Land Use, Transportation, and Recreation	<p><u>Proposed PSS Ocean Test Location</u> The operation of two marine vessels would be consistent with offshore use in the Southern California Bight. In addition, exclusion areas have been established to avoid potential impacts to existing recreational resources.</p> <p>To minimize potential impacts to transportation, the ocean test would be sited to avoid major shipping lanes and heavily utilized military operation areas. In addition, since the test vessel would be deploying a moored device, a Notice to Mariners (NOTMAR) would be issued 48 hours prior to commencement of tests. For these reasons and due to the short-term nature of the test, impacts to marine traffic would not be significant.</p>	No effect/No change from base-line conditions.
Socioeconomics	<p><u>Proposed PSS Ocean Test Location</u> Commercial shipping traffic would not be significantly affected by the proposed action. Vessels could continue to operate within a 1.0-km (0.6-mile) radius of the test location without interfering with the integrity of the test. Given the small area of ocean in which the test would occur and the short duration of the test, and since no permanent residents (low-income, minority, disadvantaged, or other) reside in the project area, the potential to disproportionately affect human health or the environment in low-income, minority or disadvantaged populations (including children) would not occur.</p>	No effect/No change from base-line conditions.

Table ES-4. Impact Summary Matrix (Page 3 of 3)

Resource	PSS Ocean Test/Southern California	No-Action Alternative
Noise	<p><u>Proposed PSS Ocean Test Location</u></p> <p><u>Air environment:</u> Project-related noise associated with the operation of two marine vessels and the moored barge would not significantly change ambient noise conditions in the area.</p> <p><u>Underwater:</u> Underwater noise produced by the surface vessels would be similar to noise produced by other vessels (e.g., depth sounders, fish finders) employed on other ships and boats operating in the area and would not significantly change underwater ambient noise conditions of the area.</p>	No effect/No change from base-line conditions.
Cultural Resources	<p><u>Proposed PSS Ocean Test Location</u></p> <p>No known underwater archaeological resources would be impacted as a result of the PSS ocean tests within the proposed ocean test location.</p>	No effect/No change from base-line conditions.
Safety and Environmental Health	<p><u>Proposed PSS Ocean Test Location</u></p> <p>During vessel operations, deployment activities, and retrieval operations, standard vessel operating safety procedures would be implemented to protect public non-participants and military personnel. In addition, retrieval of all test components would be achieved upon conclusion of the test. Therefore, given standard component retrieval procedures, impacts to public safety would not be significant.</p> <p>Exclusion areas associated with active acoustic testing of would be established as part of the proposed ocean test. In addition, the Navy would ensure no divers or dive flags are operating in the vicinity of the test vessel.</p>	No effect/No change from base-line conditions.